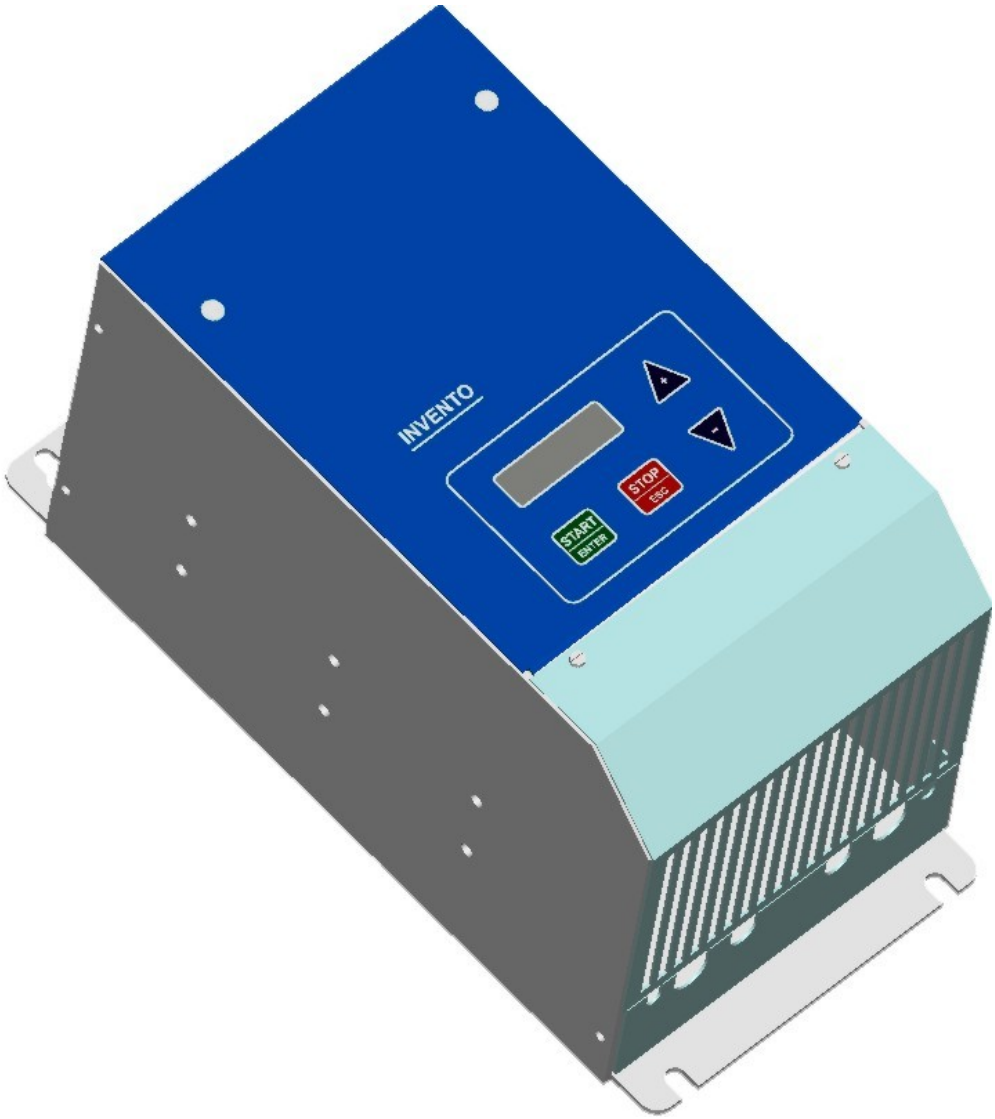
Operating instructions

EC- Controller INVENTO



INVENTO T03 / T04 / T06

This operation instruction contains important technical advice and information about safety. Therefore please pay attention to this operation instruction before unpacking, installation or any other work is undertaken on this EC-controller!

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1. *SAFETY*

Industrial safety symbols

The following symbols refer to particular dangers or give advice for save operation.

	Important, information
	Danger from electric current or high voltage!
	Important, information

1.1. Safety advice

	Domel EC- controllers are produced in accordance with the latest technical standards and our quality assurance programme which includes material and function tests ensures that the final product is of a high quality and durability. Never the less these controllers can be dangerous if they are not used and installed correctly, according to the instructions.
	EC-Controller could be life dangerous because of high voltage and its mechanical rotating parts.
	Before installing and operating this ec-controller please read this instructions carefully!

- **the electrical and mechanical parts must be protected with protective components (cover, net, etc.),**
- **only qualified staff is allowed to install the EC – Controller,**
- **system documentation must always be available,**
- **system must be installed in accordance with the local regulations.**

2. TECHNICAL DESCRIPTION

EC-Controller Invento		T03	T04	T06
Output	Rated current [A]	3x3	3x4,5	3x6,7
	Output voltage [V]	3 x 400	3 x 400	3 x 400
	Output power [kW]	1,5	2,2	3,3
	Max. output power [kW]	1,8	2,7	4,0
Input	Input voltage [V AC]	3 x 400 V + 5% - 10 %	3 x 400 V + 5% - 10 %	3 x 400 V + 5% - 10 %
	Frequency [Hz]	50 / 60	50 / 60	50 / 60
	Rated input power [kW]	1,7	2,5	3,7
	Rated input current [A]	3 × 2,8	3 × 4,1	3 × 6,2
	Max. Input power [kW]	2,0	3,0	4,5
	Max. Input current [A]	3 × 3,3	3 × 5,0	3 × 7,5
	Wire cross section [mm2]	1,0	1,0	1,5
Protective functions	Over current protection, under voltage protection			
Ambient	Ambient temperature	-10°C - +40°C	-10°C - +40°C	-10°C - +30°C
	Cooling	Forced convection	Forced convection	Forced convection
Dimensions	B x H x T (mm)	146 x 300 x 167	146 x 300 x 167	146 x 300 x 167
Operating position		Upright position	Upright position	Upright position

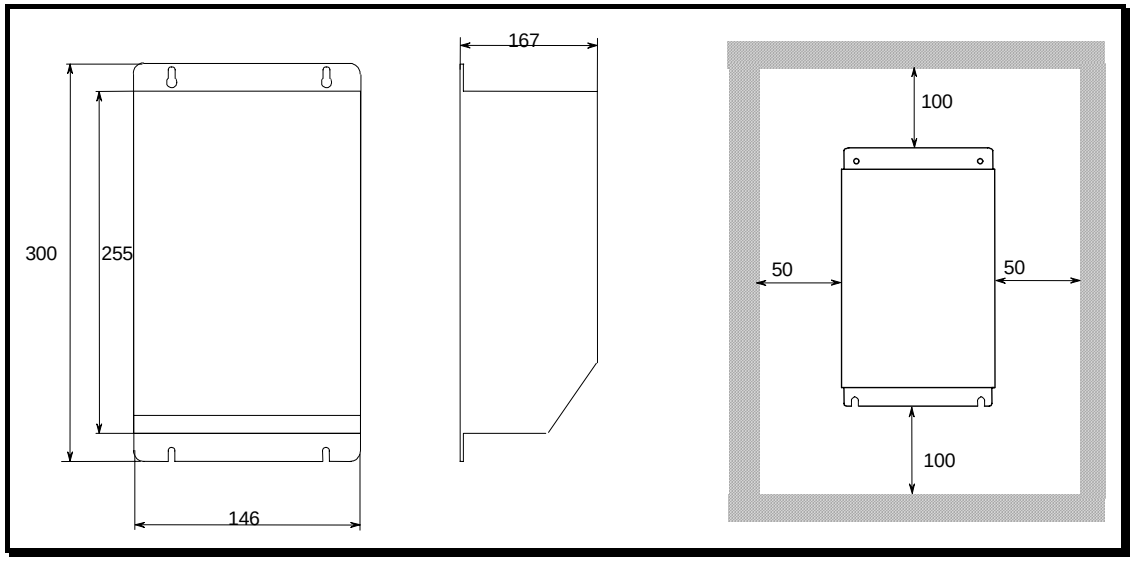
Table 1 Specifications

3. DESCRIPTION / FUNCTION

EC-controllers of the Invento range T03, T04 and T06 are necessary to operate Domel brushless sensorless EC motors. These EC motors must not be operated with the direct power supply and therefore need an EC-controller.
The speed of the EC motors can be adjusted steplessly with the EC-controller. The actual speed is shown on the four-digit LCD-display on the front of the controller.

4. MECHANICAL INSTALLATION

- **EC-Controller is mounted into an upright position,**
- **There has to be enough space around the EC-Controller for undisturbed airflow for the cooling (figure 1),**
- **It is not allowed to install the EC-Controller into polluted atmosphere (aggressive gas, concentration of dust and damp, fat, corrosive substance).**



❑

Figure 1 *dimension diagram and minimum distances*

⚠	**Maximum ambient temperature is 40°C for T03, T04 and 30°C for T06**

For the fitting of EC-Controller we need 4 holes in the wall, figure 2. Max. screw diameter is 5 mm.

Fixing:

- ❑ **Partly screw upper and lower screws,**
- ❑ **Hang up the EC-controller on the screws,**
- ❑ **Screw down upper and lower screws.**

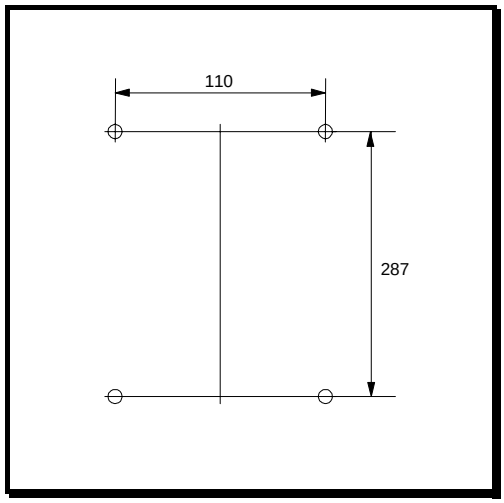


Figure 2 fixing holes

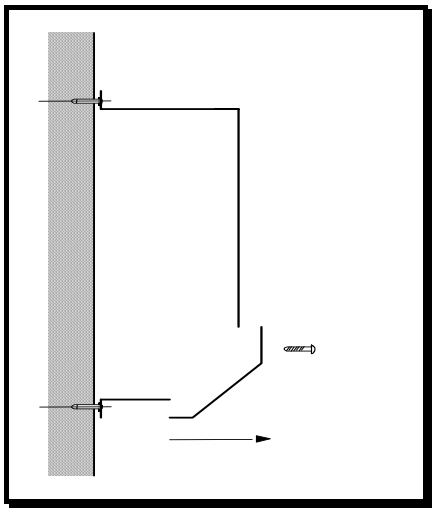


Figure 3 removing the cover

5. ELECTRICAL INSTALLATION

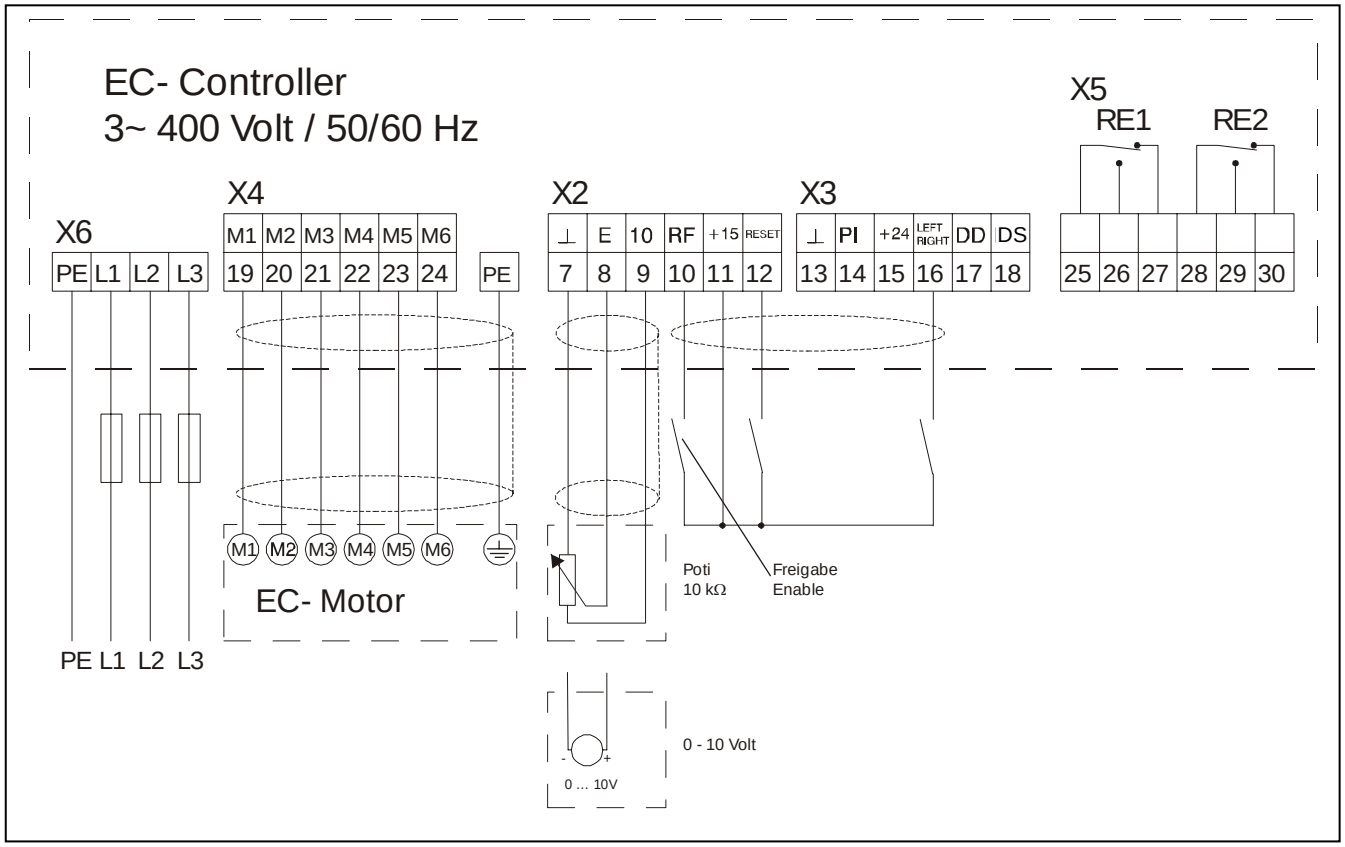


Figure 4a *connection diagramm ec-controller*

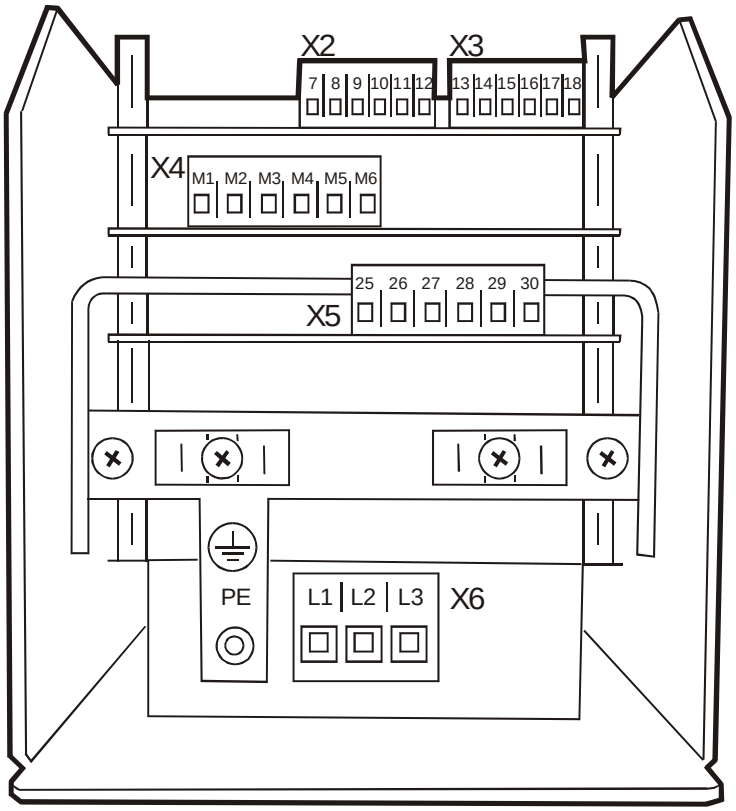


Figure 4b *connection diagramm ec-controller / plug connection*

⚠	**When connecting plugs please see Figure 4b.** **Wrong connection might destroy the controller.**

6. CONNECTION

⚠	**Before initial operation we have to check up, that there are no mechanical parts (wires, female screws, filings…) in the housing of the EC-Controller** **We have to check if the line voltage suit the value on the data plate**

6.1. Mains

The mains is connected to terminals L1, L2 and L3, which are located on the lower part of the EC-controller. Protective earth PE is connected to an earth screw.

⚠	**First of all protective earth has to be connected.**

6.2. Motor connection

The motor and EC-controller are connected with two cables:

- **Six wire cable for the motor connection – terminals 19 – 24,**
- **Earth wire diameter 10 mm^2 - Protective earth.**

7. WAYS OF *ADJUSTMENT AND CONTROLLING / SETTING* THE PARAMETERS OF THE CONTROLLER

All the parameters are easily adjusted through the user interface on the top of the Invento controller.

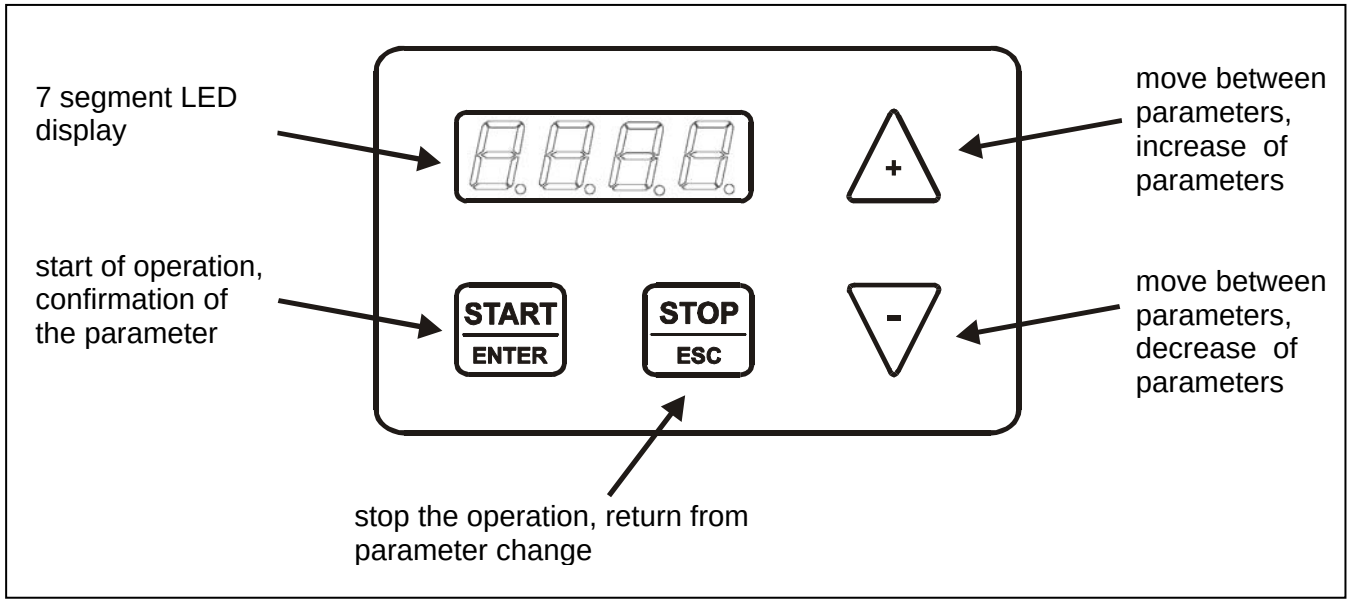


Figure 5: The outline of Invento user interface

On the operating flowchart you can see how to move round the menu and set up the parameters by using keys START/ENTER, STOP/ESC, (+) and (-).

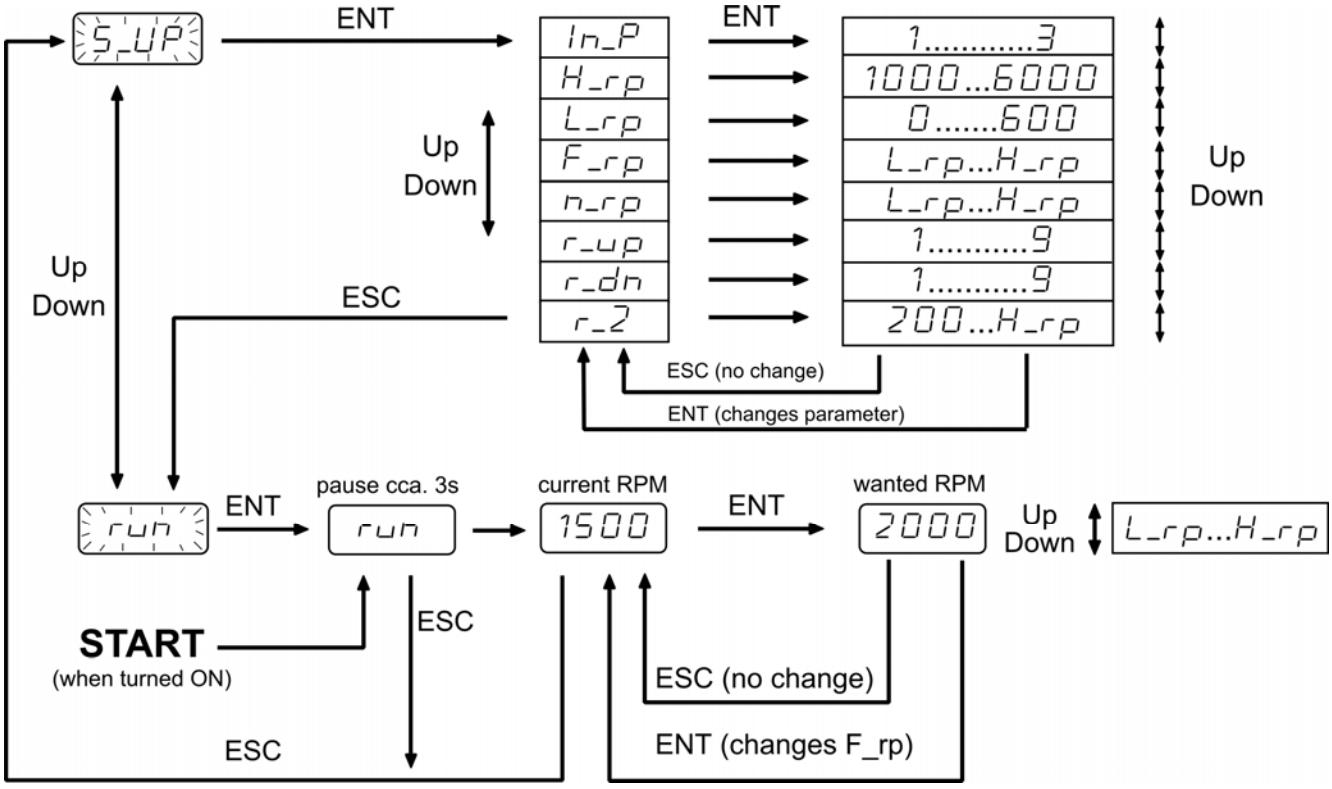


Figure 6: operating flowchart

7.1. Parameter description

7.1.1 Selecting regulation input

In_P (1…3)
By setting this parameter you select which type of regulation input you would like to have.

1	Analog input - E
2	Sensor input - PI
3	Keyboard input – setup of speed by keys between operation or F_Rpm in Setup mode

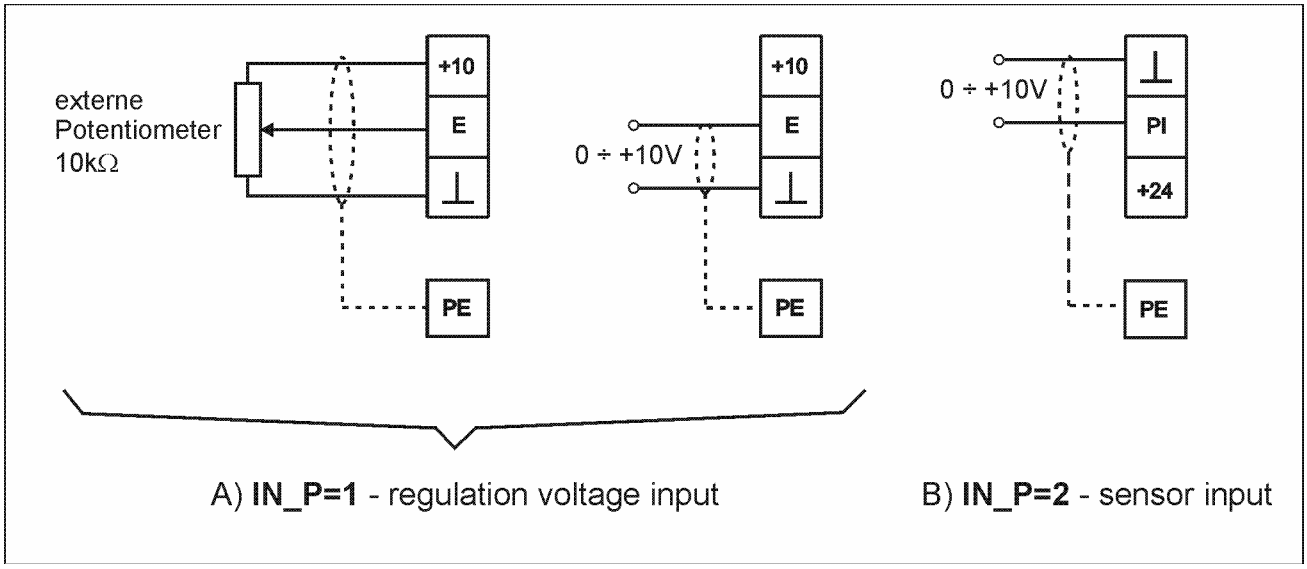


Figure 7: regulation inputs

If IN_P=1 user must provide one of the external means of regulation (See **Figure 7: A**). When using a sensor the circuit compares the values between regulation voltage input (E – terminal 8) and sensor input (PI – terminal 14). A voltage of +24V DC/40mA (terminal 15) is provided to supply the sensor.

7.1.2. Setting maximal RPM of the motor

H_rp (1000…6000)
By setting this parameter you set the maximal RPM limit. This limits the RPM of the motor on all of the input signals. For the value of parameter see **table1 in section 9**.

For example: if you set H_rp at 2000RPM at 10V of regulation voltage on input E the motor will run at 2000RPM.

7.1.3. Setting minimal RPM of the motor

L_rp (0…600)
By setting this parameter you set the minimal RPM limit. This sets the start of the motor at preset minimal value at minimal voltage input. For the value of parameter see **table1 in section 9**.

For example: if you set L_rp at 300RPM at 0V of regulation voltage on input E the motor will run at 300RPM.

7.1.4. Setting fixed day RPM of the motor

F_rp (L_rp…H_rp)
If you select IN_P=3 than you selected fixed day RPM. This means that the controller will regulate the RPM of the motor to match the selected F_rp value of the RPM.

You can change this value during operation in run mode by pressing ENT button. You get displayed the previous set value and by pressing the UP or DOWN buttons you can change it. The value can be changed between previusely set value of L_rp and H_rp. By pressing ENT button you verify the new value, which will take immediate effect. If you don't want to change the value you can exit by pressing ESC button.

7.1.5. Setting fixed night RPM of the motor

n_rp (L_rp…H_rp)
If you select IN_P=3 than you selected fixed day value of the wanted RPM. But if you would want another preset value to take effect (so called night value), you apply 15V(terminal 11) to a DS input. This means that the controller will regulate the RPM of the motor to match the selected **n_rp** value of the RPM.

You can change this value during operation while in **run mode** if 15V(terminal 11) is applied to DS. By pressing ENT button you get displayed the previous set value and by pressing the UP or DOWN buttons you can change it. The value can be changed between previously set value of L_rp and H_rp. By pressing ENT button you verify the new value, which will take immediate effect. If you don't want to change the value you can exit by pressing ESC button.

7.1.6. Setting ramp up

r_up (1…9)
Ramp up means the response of acceleration of the motor at positive change of regulation voltage. Selected value 1 means the fastest response while 9 is the slowest; it affects all regulation inputs selected by In_P (the foreseen minimal value for certain ventilator + motor set can be selected from the table)

For the value of parameter see **table1 in section 9**.

7.1.7. Setting ramp down

r_dn (1…9)
Ramp down means the response of slowing down the motor at negative change of regulation voltage. Selected value 1 is the fastest response while 9 is the slowest; it affects all regulation inputs selected by In_P (the foreseen minimal value for certain ventilator + motor set can be selected from the table)

For the value of parameter see **table1 in section 9**.

7.1.8. Setting the r_2 value

r_2 (200…H_rp)
This parameter is not used.

7.2 Setting of the parameters

When the load voltage is applied to the controller it immediately starts by setting in the **run** mode. You have cca. 3 seconds to stop operation before it begins by pressing ESC button!

A blinking S_UP sign appears, that means setup mode. To enter the setup mode press ENT button and hold it until **S_UP** stops blinking and In_P occurs. By pressing buttons UP and DOWN you can select the parameter you want to change and then press ENT and hold it until parameter preset value occurs. Than you can change the value by pressing buttons UP and DOWN. You verify the value by pressing ENT or you can exit without changing the parameter with ESC button. This applies to all the parameters in **S_UP** mode.

7.3. Starting the operation

When all the parameters are set, you can exit the setup mode by pressing ESC. A blinking **run** sign appears. By pressing the ENT until run sign stops blinking you verify the operation of electronics. You have cca. 3 seconds to stop operation before it begins.

When the load voltage is applied to the controller it immediately starts by setting in the **run** mode. You have cca. 3 seconds to stop operation before it begins.

Note: you must apply +15V(terminal 11) to RF (terminal 10) to start the motor (fan) !

7.4. Run mode

You can start the operation by turning on the line voltage and the electronics will set itself in the **run** mode. You can also start the operation by exiting from the **setup** mode and pressing ENT button. Led display displays the value of the RPM of the motor. The motor will operate according to the type of the regulation selected in S_UP mode in IN_P parameter setup. You can stop its operation by pressing ESC button, which will put you in setup mode.

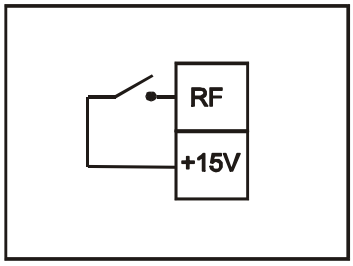
If in IN_P mode you selected parameter 3 (keyboard selected wanted value of RPM) you can change this value during operation in **run mode** by pressing ENT button. You get displayed the previous set value and by pressing the UP or DOWN buttons you can change it. By pressing ENT button you verify the new value, which will take immediate effect. If you don't want to change the value you can exit by pressing ESC button.

8. OTHER EXTERNAL CONECTION TERMINALS

8.1 Input Start – Stop (RF terminal)

RF input is designed for stopping and starting the drive while connected to the mains. It can be done by just connecting RF terminal with +15V(terminal 11) terminal with an wire or via external switch.

Note: for the motor to start you must apply +15V(terminal 11) to RF (terminal 10)!



8.2 Input direction of rotation (CW, CCW)

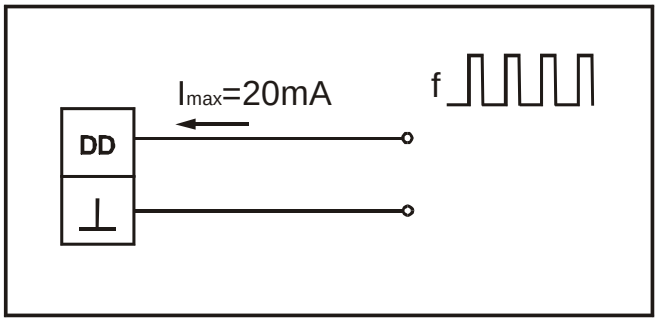
This can be made by connecting +15V(terminal 11) to the terminal 16.

	The motor has to stand still when changing the direction of rotation!

8.3 Reset input

The controller has an over-current protection. This protection activates if there is short circuit between motor wires, to earth or if a power transistor fails. By connecting the terminal R (12) with +15V (terminal 11) for about one second over-current protection can be reset and if controller is not damaged it will start to operate. If not – please consult the supplier!

8.4 Speed output – digital



The pulse frequency at the terminal DD (17) is proportional to the speed of the motor. Output is "open collector" type, max. current 20mA, voltage 24V(fig. xx)

n = f x 2

n – rpm
f - frequency of pulses

Example: measured frequency at the terminal DD is 1400Hz. The speed of the motor is 1400 x 2 = 2800 rpm

8.5 Operating relay RE1 (terminal 25, 26, 27)

Until the RF signal is set (0V on RF) the relay contacts are closed between 25 and 27. If RF is set (+15V) the relay contacts 25 and 26 are closed.

If a fault signal has occurred on controller during the operation the RE1 switches the contact back to 25 and 27 and Err sign would be blinking on LED display.

8.6 Fault relay RE2 (terminal 28, 29, 30)

The controller is monitoring +15V supply, DC link voltage and over current protection. If the controller is ready to operate, contacts 28 and 29 are closed. If fault occurs (+15V supply to low, or DC link voltage to low, or over current protection activated) contacts 28 and 30 are closed and Err signal is blinking on LED display.

9. PARAMETER SETUP TABLE FOR MOTORS AND VENTILATORS

Ventilator	Motor	H_rp (1000-6000)	L_rp (0-600)	R_up (1-9) *	R_dn (1-9) *

*** It is sugested that R_up and R_dn are the same value**

Table 1: table of parameters for specific aplication

10. SECURITY EXAMINATIONS BEFORE START-UP

10.1. Security examinations before start-up

- ❑ **the adjustments according to the operating manual (chapter 6) and fan data plate are made correct,**
- ❑ **that the mains voltage corresponds to the data on the ec- controller data plate,**
- ❑ **that the controller is installed in accordance with assembly instruction (chapter 3),**
- ❑ **that the drive is not energized (main switches out),**
- ❑ **that the motor is moveable freely by hand,**
- ❑ **that the connecting terminals by the mains and motor connection are well tightened.**

10.2. Before the first operation is to be guaranteed

The value of parameter H_rp must not be higher than max allowed rpm of the fan.

- ❑ **Input RF deactivate. If there is switch between RF and +15V is present, this is to be opened for the first operating.**
- ❑ **That the set value is 0V DC when In_p is 1 or 2.**
- ❑ **That F-rp is set to low speed when In_p is 3**
- ❑ **main switch on.**

10.3. Operation

Three to four seconds after connecting the ec- controller to the mains the controller is ready to operate.

- ❑ **Close the switch at RF and +15V (terminal 10 and 11)**
- ❑ **Slowly increase set value (terminal 8) when In_p is 1 or 2. The motor (fan) starts turning.**
- ❑ **Check, if the fan is rotating in the right direction.**
- ❑ **When In_p is 3 the motor (fan) will accelerate to the set value of the parameter F_rp.**
- ❑ **Check, if the fan is rotating in the right direction.**
- ❑ **If the direction of rotation is right, you can increase the speed.**
- ❑ **If the direction of rotation is wrong, you have to stop the drive and change the direction of rotation. (at zero speed only)**
- ❑ **Repeat the starting procedure.**

11. SERVICE, ADDRESS OF PRODUCER

Domel-products are subject to steady quality controls and are in accordance to valid regulations.
In case you have any questions with regard to our products please contact either your constructor of your air handling unit or directly to one of our distributors:

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12. NOTE